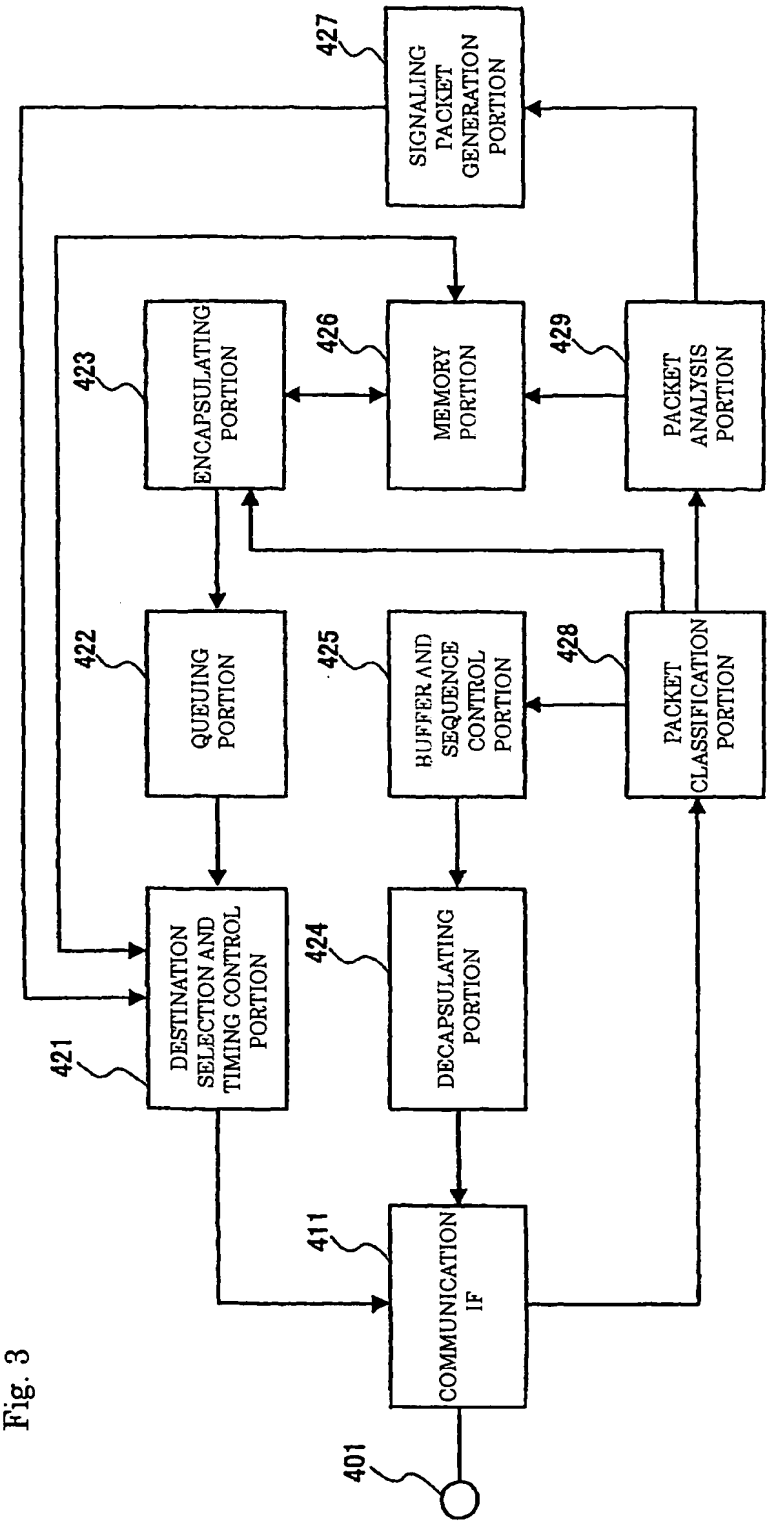

Fig. 3

BEST AVAILABLE COPY

EP 1526725

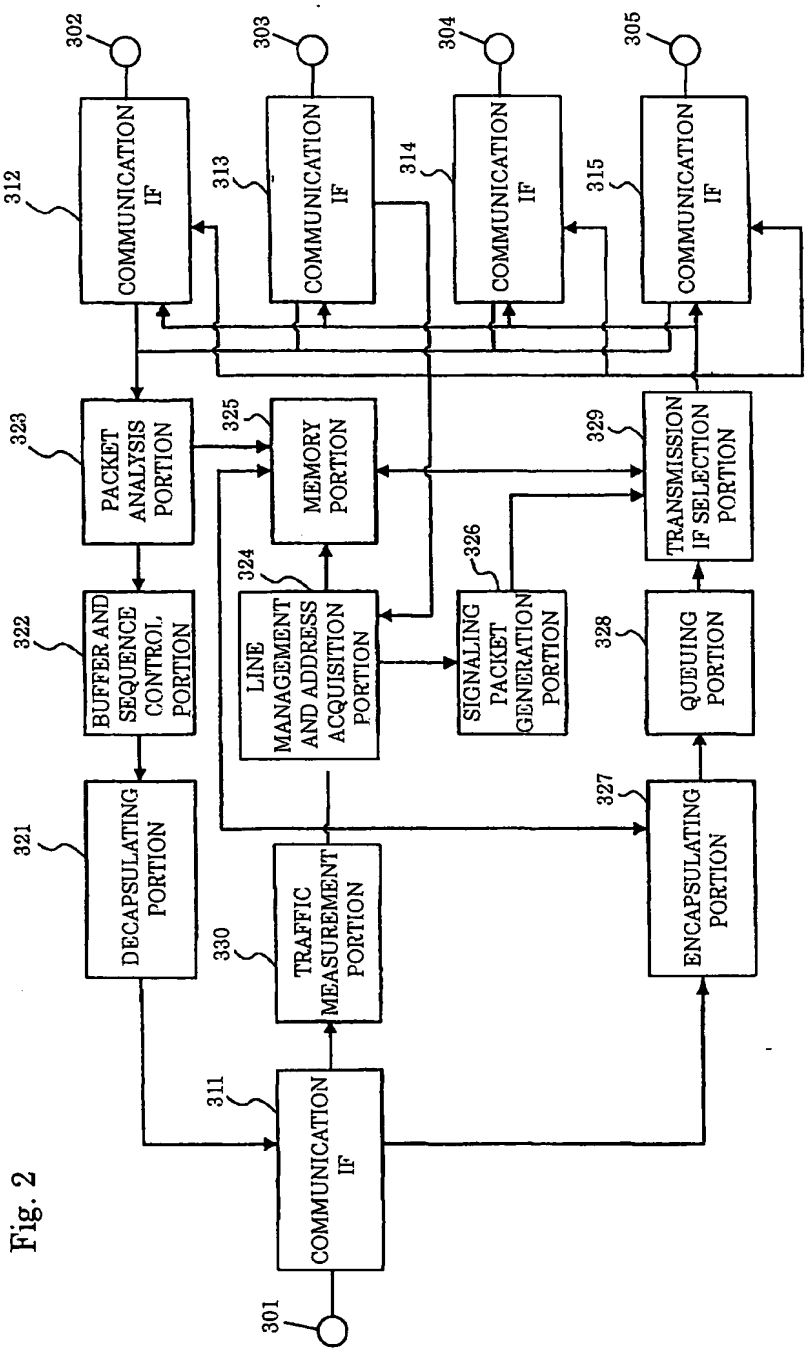

Fig. 2

Fig. 4

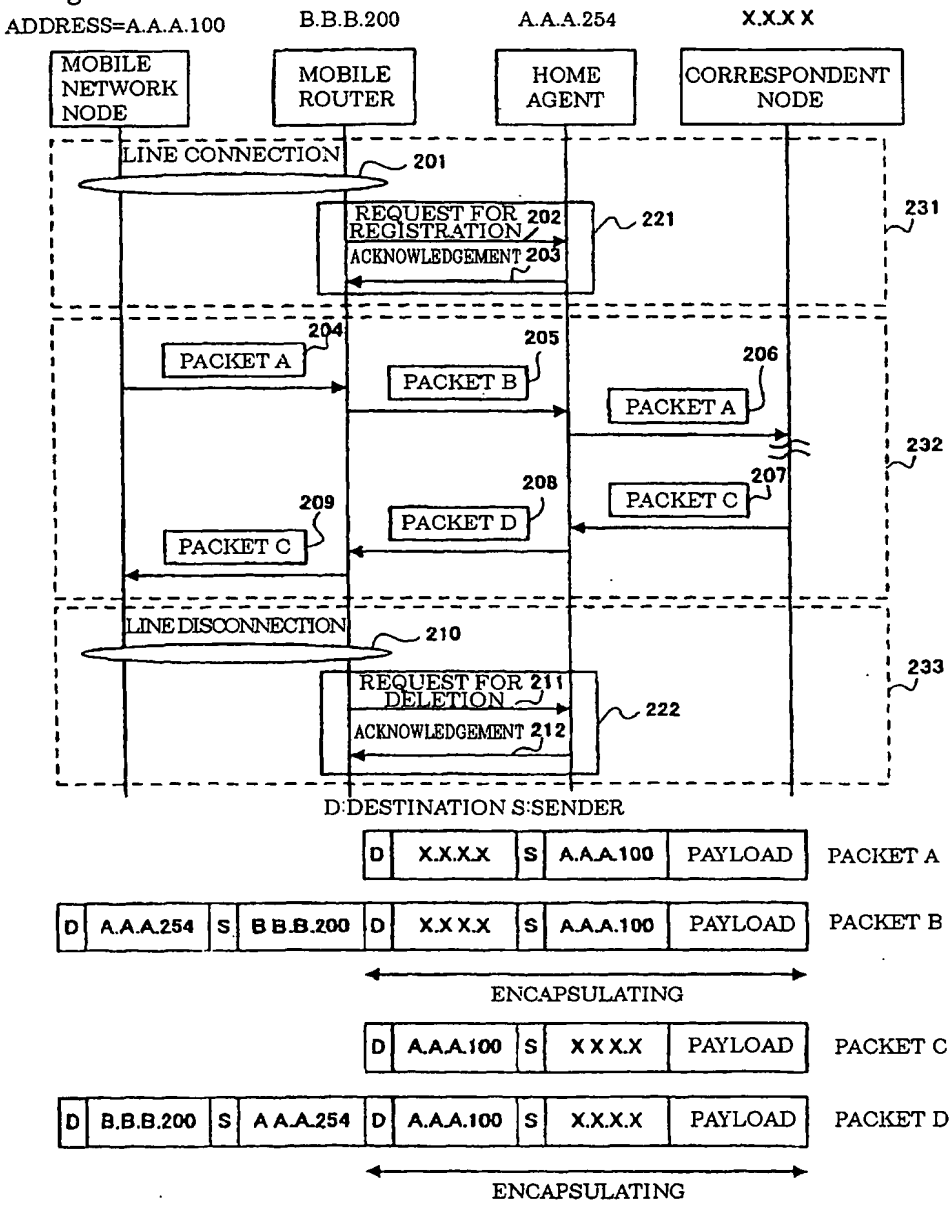
ADDRESS=A.A.A.100
B.B.B.200
A.A.A.254
X.X.X.X
MOBILE NETWORK NODE
MOBILE ROUTER
HOME AGENT
CORRESPONDENT NODE
LINE CONNECTION
201
REQUEST FOR REGISTRATION
202
ACKNOWLEDGEMENT
203
221
231
PACKET A
204
PACKET B
205
PACKET A
206
232
PACKET C
207
PACKET D
208
PACKET C
209
LINE DISCONNECTION
210
REQUEST FOR DELETION
211
ACKNOWLEDGEMENT
212
222
233
D:DESTINATION S:SENDER
D X.X.X.X S A.A.A.100 PAYLOAD
PACKET A
D A.A.A.254 S B.B.B.200 D X.X.X.X S A.A.A.100 PAYLOAD
PACKET B
ENCAPSULATING
D A.A.A.100 S X.X.X.X PAYLOAD
PACKET C
D B.B.B.200 S A.A.A.254 D A.A.A.100 S X.X.X.X PAYLOAD
PACKET D
ENCAPSULATING

Fig. 5

HOME ADDRESS	COMMUNICATION IF ADDRESS	COMMUNICATION IF NUMBER	COMMUNICATION IF TYPE	BANDWIDTH	STATUS
A.A.A. 254/24	B.B.B.200	1	IMT-2000	384kbps	BEING REGISTERED
	B.B.B.201	2	IMT-2000	384kbps	REGISTERED
	B.B.B.202	3	IMT-2000	0	BEING DELETED
	C.C.C.50	4	WIRELESS LAN	11Mbps	REGISTERED

Fig. 6

HOME ADDRESS	COMMUNICATION IF ADDRESS	COMMUNICATION IF TYPE	BANDWIDTH	NEXT PACKET TRANSMISSION ENABLING TIME
A.A.A. 254/24	B.B.B.200	IMT-2000	384kbps	10.01
	B.B.B.201	IMT-2000	384kbps	10.03
	C.C.C.50	WIRELESS LAN	11Mbps	10.003

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Fig. 7

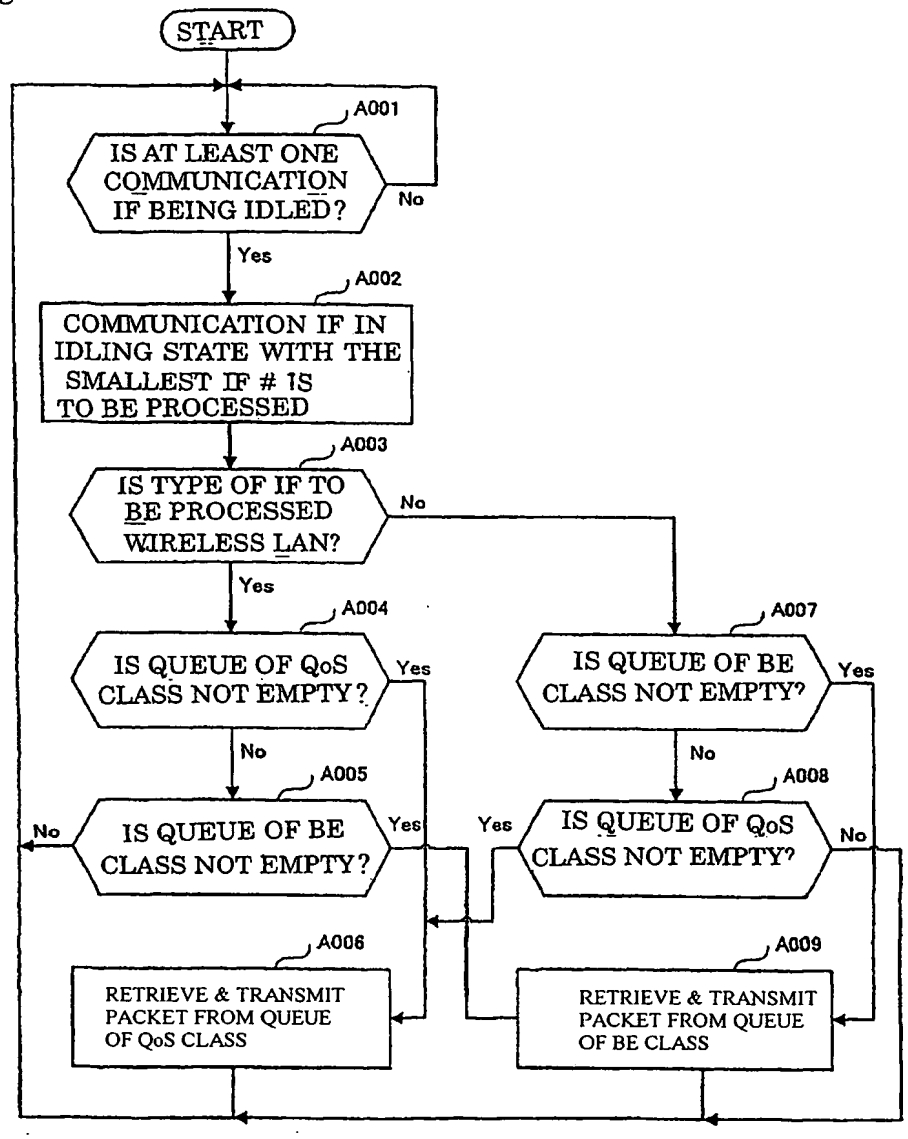

START
A001
IS AT LEAST ONE COMMUNICATION IF BEING IDLED?
No
Yes
A002
COMMUNICATION IF IN IDLING STATE WITH THE SMALLEST IF # IS TO BE PROCESSED
A003
IS TYPE OF IF TO BE PROCESSED WIRELESS LAN?
No
Yes
A004
IS QUEUE OF QoS CLASS NOT EMPTY?
Yes
No
A005
IS QUEUE OF BE CLASS NOT EMPTY?
No
Yes
A006
RETRIEVE & TRANSMIT PACKET FROM QUEUE OF QoS CLASS
A007
IS QUEUE OF BE CLASS NOT EMPTY?
Yes
No
A008
IS QUEUE OF QoS CLASS NOT EMPTY?
Yes
No
A009
RETRIEVE & TRANSMIT PACKET FROM QUEUE OF BE CLASS

Fig. 8

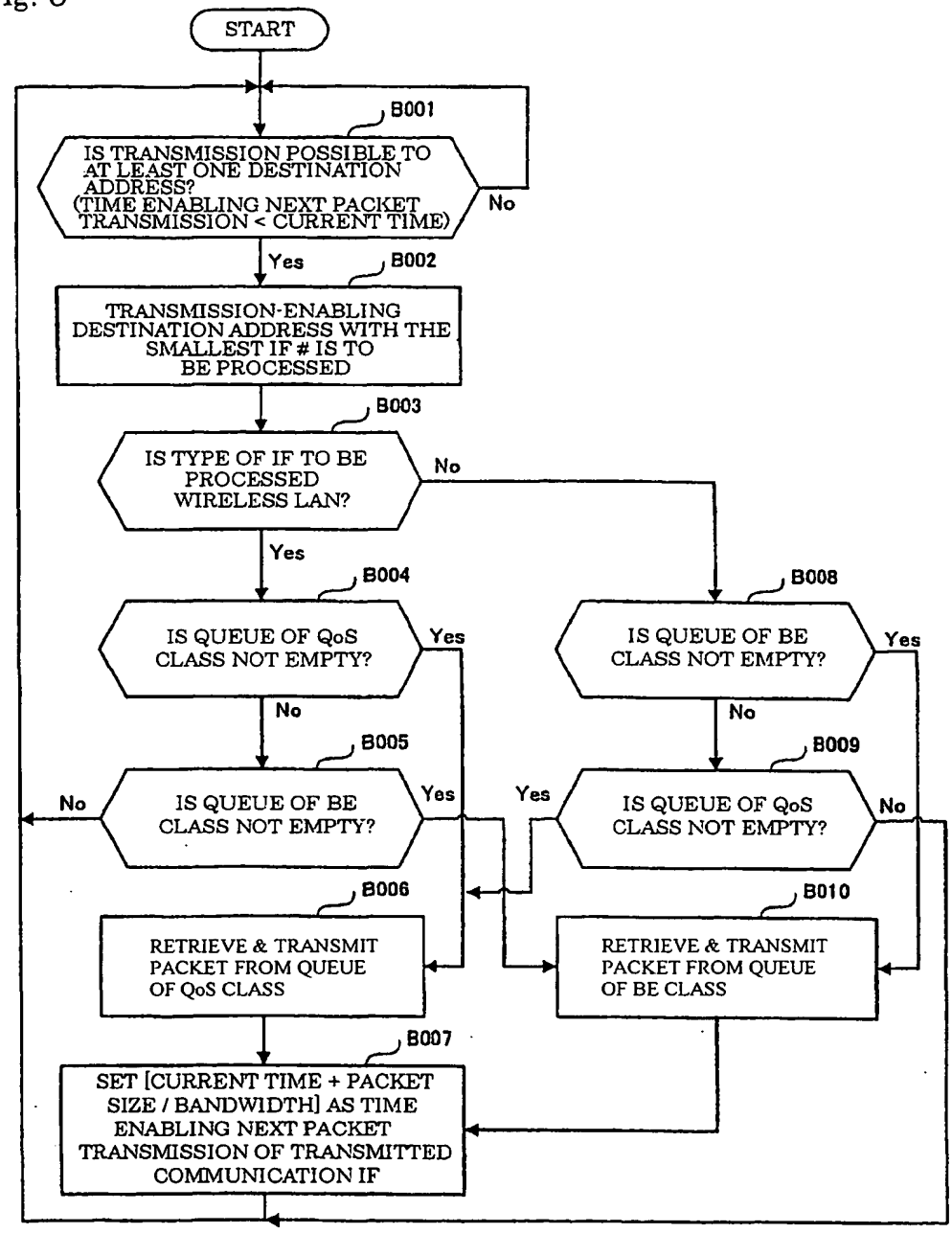

START
B001
IS TRANSMISSION POSSIBLE TO AT LEAST ONE DESTINATION ADDRESS? (TIME ENABLING NEXT PACKET TRANSMISSION < CURRENT TIME)
No
Yes
B002
TRANSMISSION-ENABLING DESTINATION ADDRESS WITH THE SMALLEST IF # IS TO BE PROCESSED
B003
IS TYPE OF IF TO BE PROCESSED WIRELESS LAN?
No
Yes
B004
IS QUEUE OF QoS CLASS NOT EMPTY?
Yes
No
B005
IS QUEUE OF BE CLASS NOT EMPTY?
No
Yes
B006
RETRIEVE & TRANSMIT PACKET FROM QUEUE OF QoS CLASS
B008
IS QUEUE OF BE CLASS NOT EMPTY?
Yes
No
B009
IS QUEUE OF QoS CLASS NOT EMPTY?
Yes
No
B010
RETRIEVE & TRANSMIT PACKET FROM QUEUE OF BE CLASS
B007
SET [CURRENT TIME + PACKET SIZE / BANDWIDTH] AS TIME ENABLING NEXT PACKET TRANSMISSION OF TRANSMITTED COMMUNICATION IF

Fig. 9

HOME ADDRESS	C/O ADDRESS	BANDWIDTH	BILLING SYSTEM	
			6:00 TO 8:00	18:00 TO 6:00
A.A.A. 254/24	B.B.B.200	384kbps	MEASURED-RATE (¥0.05 / PACKET)	MEASURED-RATE (¥0.05 / PACKET)
	B.B.B.201	144kbps	MEASURED-RATE (¥0.05 / PACKET)	FLAT-RATE
	C.C.C.50	11Mbps	FLAT-RATE	FLAT-RATE

Fig. 10

HOME ADDRESS	C/O ADDRESS	BANDWIDTH	BILLING SYSTEM	
			EASTERN JAPAN	WESTERN JAPAN
A.A.A. 254/24	B.B.B.200	384kbps	MEASURED-RATE (¥0.01 / PACKET)	MEASURED-RATE (¥0.01 / PACKET)
	B.B.B.201	144kbps	MEASURED-RATE (¥0.02 / PACKET)	FLAT-RATE
	C.C.C.50	11Mbps	FLAT-RATE	FLAT-RATE

10/526725

Fig. 11

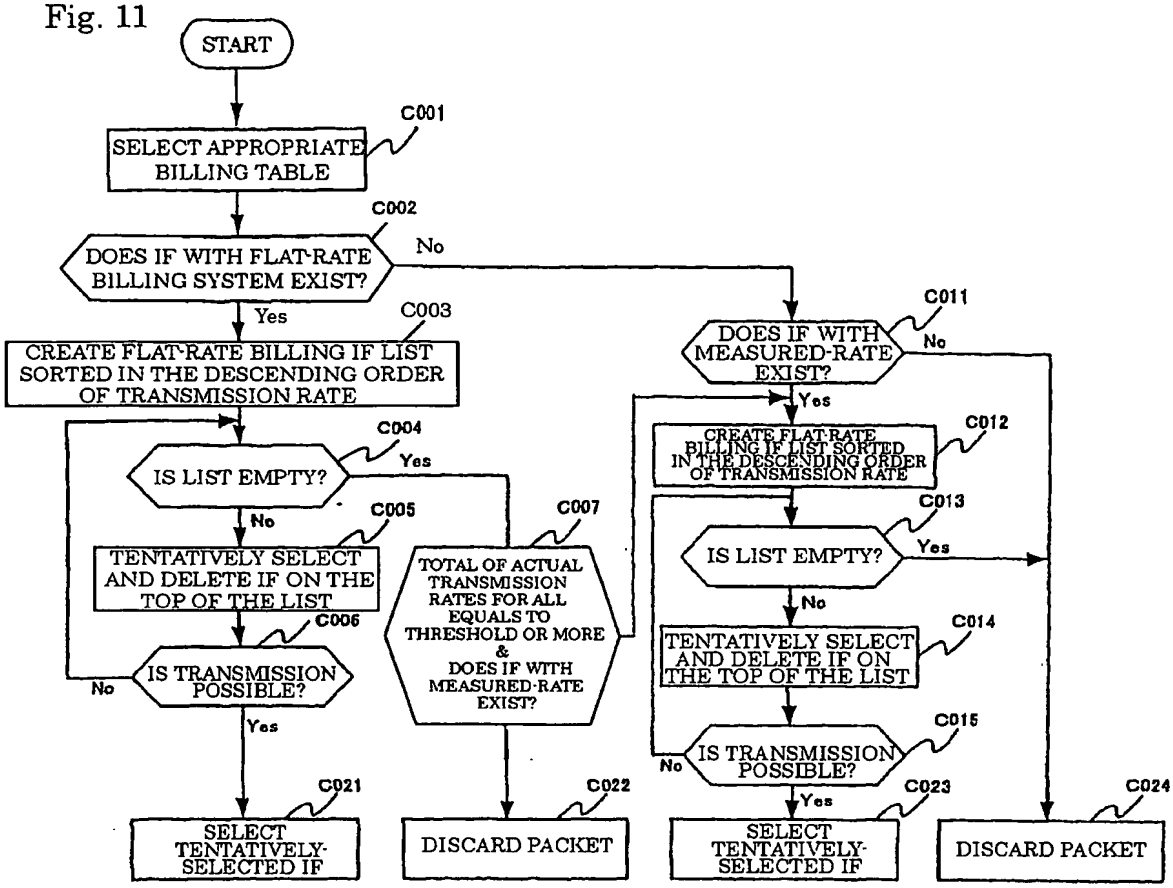

START
C001
SELECT APPROPRIATE BILLING TABLE
C002
DOES IF WITH FLAT-RATE BILLING SYSTEM EXIST?
No
Yes
C003
CREATE FLAT-RATE BILLING IF LIST SORTED IN THE DESCENDING ORDER OF TRANSMISSION RATE
C004
IS LIST EMPTY?
Yes
No
C005
TENTATIVELY SELECT AND DELETE IF ON THE TOP OF THE LIST
C006
IS TRANSMISSION POSSIBLE?
No
Yes
C007
TOTAL OF ACTUAL TRANSMISSION RATES FOR ALL EQUALS TO THRESHOLD OR MORE & DOES IF WITH MEASURED-RATE EXIST?
C011
DOES IF WITH MEASURED-RATE EXIST?
No
Yes
C012
CREATE FLAT-RATE BILLING IF LIST SORTED IN THE DESCENDING ORDER OF TRANSMISSION RATE
C013
IS LIST EMPTY?
Yes
No
C014
TENTATIVELY SELECT AND DELETE IF ON THE TOP OF THE LIST
C015
IS TRANSMISSION POSSIBLE?
No
Yes
C021
SELECT TENTATIVELY-SELECTED IF
C022
DISCARD PACKET
C023
SELECT TENTATIVELY-SELECTED IF
C024
DISCARD PACKET

Fig. 12

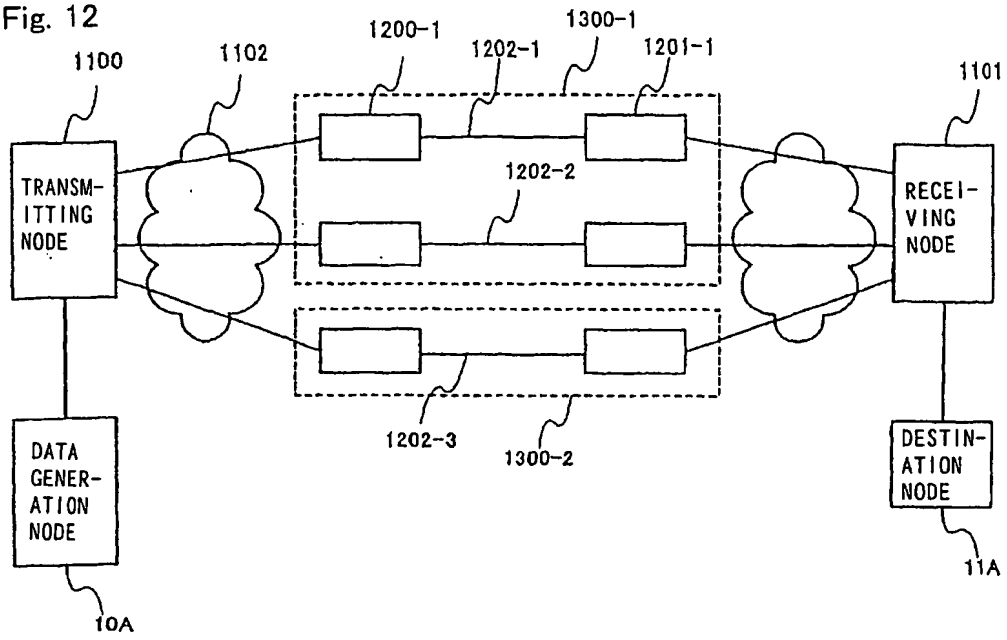

1100
1102
1200-1
1202-1
1300-1
1201-1
1101
TRANSM-
ITTING
NODE
1202-2
RECEI-
VING
NODE
1202-3
1300-2
DATA
GENER-
ATION
NODE
DESTIN-
ATION
NODE
10A
11A

Fig. 13

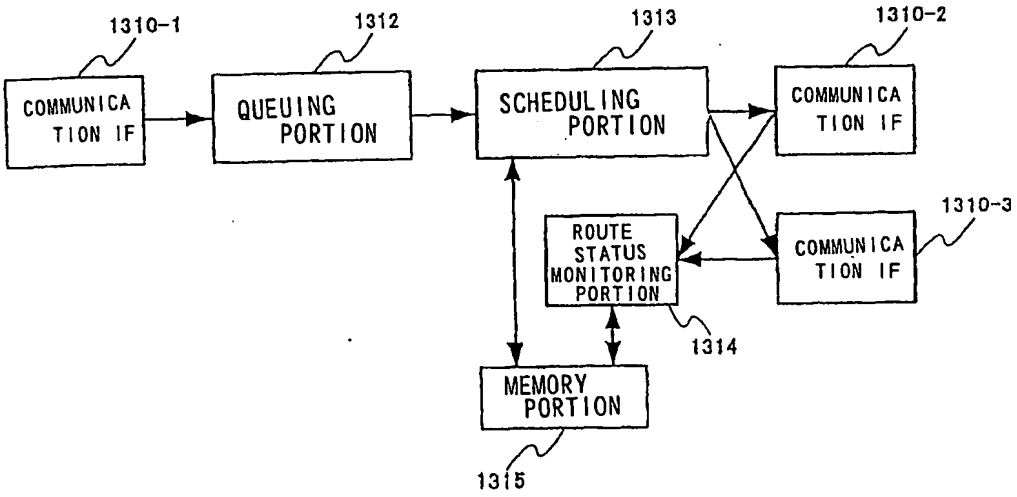

1310-1
1312
1313
1310-2
COMMUNICATION IF
QUEUING PORTION
SCHEDULING PORTION
COMMUNICATION IF
1310-3
ROUTE STATUS MONITORING PORTION
COMMUNICATION IF
1314
MEMORY PORTION
1315

Fig. 24

2400

COMMUNICATION IF TYPE	STATUS	DOWNLOAD COMMUNICATION RATE	UPLOAD COMMUNICATION RATE	NUMBER OF RECEIVED PACKETS PER UNIT HOUR	NUMBER OF TRANSMITTED PACKETS PER UNIT HOUR	CONNECTION TIME	LINE UTILIZATION
PDC#1	off	0kbps	0kbps	0	0	0	–
PDC#2	off	0kbps	0kbps	0	0	0	–
UMTS#1	on	256kbps	53kbps	1260000	6180000	–	100%
UMTS#2	on	192kbps	45kbps	960000	5280000	–	100%
1×#1	on	56kbps	36kbps	240000	4200000	–	100%
1×#2	off	0kbps	0kbps	0	0	–	–
1×EV-DO#1	on	1200kbps	120kbps	6000000	14040000	–	100%
1×EV-DO#2	on	500kbps	80kbps	2520000	9360000	–	100%

10/526725

Fig. 25

2500

COMMUNICATION IF TYPE	STATUS	WITHIN/ WITHOUT AREA	RECEIVING QUALITY
PDC#1	off	WITHIN AREA	GOOD
PDC#2	off	WITHIN AREA	GOOD
UMTS#1	on	WITHIN AREA	GOOD
UMTS#2	on	WITHIN AREA	GOOD
1×#1	on	WITHIN AREA	GOOD
1×#2	off	WITHIN AREA	GOOD
1×EV-DO#1	on	WITHIN AREA	GOOD
1×EV-DO#2	on	WITHIN AREA	GOOD

Fig. 26

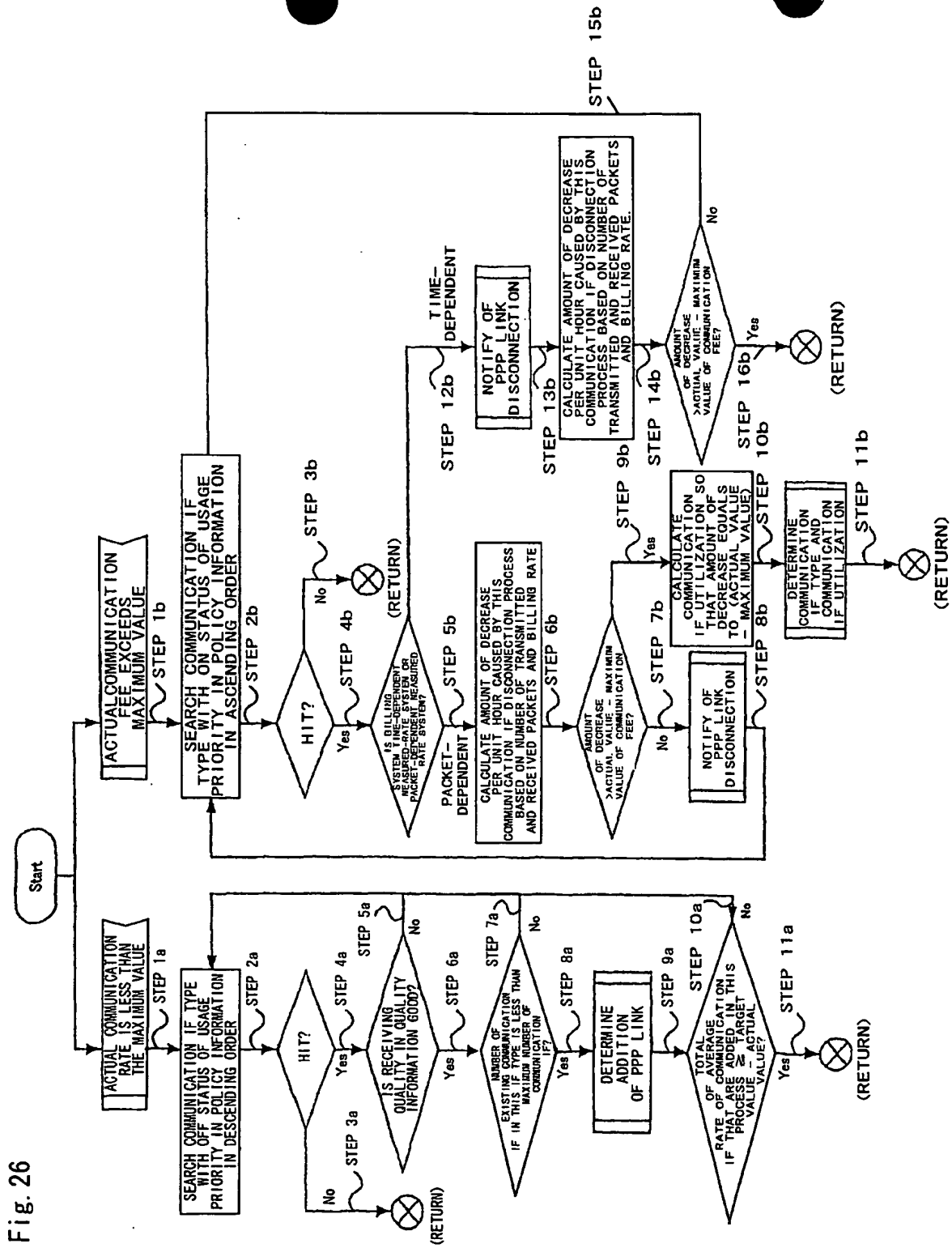

Start
ACTUAL COMMUNICATION RATE IS LESS THAN THE MAXIMUM VALUE
STEP 1a
SEARCH COMMUNICATION IF TYPE WITH OFF STATUS OF USAGE PRIORITY IN POLICY INFORMATION IN DESCENDING ORDER
STEP 2a
HIT?
No
STEP 3a
(RETURN)
Yes
STEP 4a
IS RECEIVING QUALITY IN QUALITY INFORMATION 60000?
No
STEP 5a
Yes
STEP 6a
NUMBER OF EXISTING COMMUNICATION IF IN THIS IF TYPE IS LESS THAN MAXIMUM NUMBER OF COMMUNICATION IF?
No
STEP 7a
Yes
STEP 8a
DETERMINE ADDITION OF PPP LINK
STEP 9a
TOTAL RATE OF AVERAGE COMMUNICATION IF THAT ARE ADDED IN THIS PROCESS ≧ TARGET VALUE - ACTUAL VALUE?
No
STEP 10a
Yes
STEP 11a
(RETURN)
ACTUAL COMMUNICATION FEE EXCEEDS MAXIMUM VALUE
STEP 1b
SEARCH COMMUNICATION IF TYPE WITH ON STATUS OF USAGE PRIORITY IN POLICY INFORMATION IN ASCENDING ORDER
STEP 2b
HIT?
No
STEP 3b
(RETURN)
Yes
STEP 4b
IS BILLING METHOD DESIGNATED MEASURED-RATE SYSTEM OR PACKET-DEPENDENT MEASURED RATE SYSTEM?
PACKET-DEPENDENT
STEP 5b
TIME-DEPENDENT
STEP 12b
CALCULATE AMOUNT OF DECREASE PER UNIT HOUR CAUSED BY THIS COMMUNICATION IF DISCONNECTION PROCESS BASED ON NUMBER OF TRANSMITTED AND RECEIVED PACKETS AND BILLING RATE.
STEP 6b
NOTIFY OF PPP LINK DISCONNECTION
STEP 13b
AMOUNT OF DECREASE >ACTUAL VALUE - MAXIMUM VALUE OF COMMUNICATION FEE?
No
STEP 14b
Yes
STEP 15b
STEP 16b
(RETURN)
AMOUNT OF DECREASE >ACTUAL VALUE - MAXIMUM VALUE OF COMMUNICATION FEE?
No
STEP 7b
Yes
STEP 8b
NOTIFY OF PPP LINK DISCONNECTION
STEP 9b
CALCULATE COMMUNICATION IF UTILIZATION SO THAT AMOUNT OF DECREASE EQUALS TO (ACTUAL VALUE - MAXIMUM VALUE)
STEP 10b
DETERMINE COMMUNICATION IF TYPE AND COMMUNICATION IF UTILIZATION
STEP 11b
(RETURN)

Fig. 27

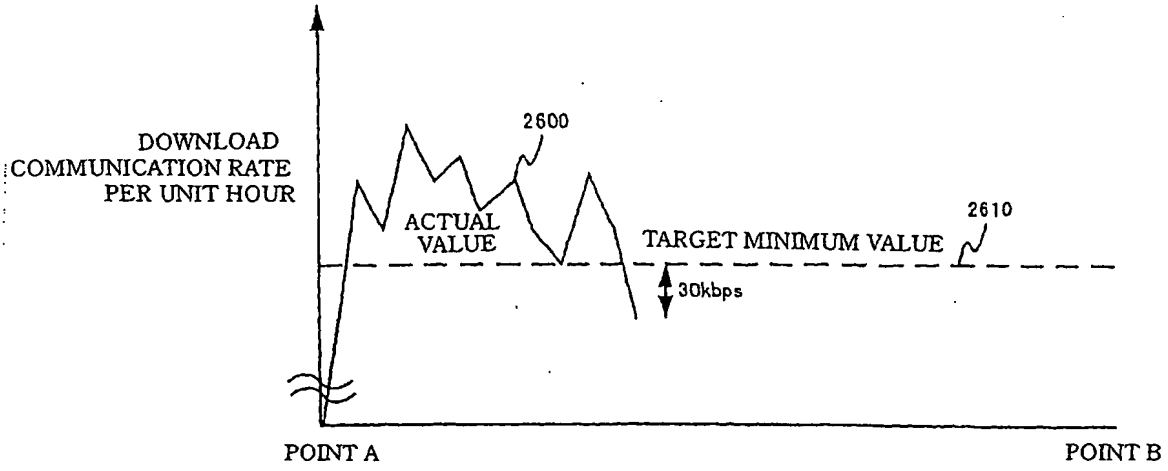
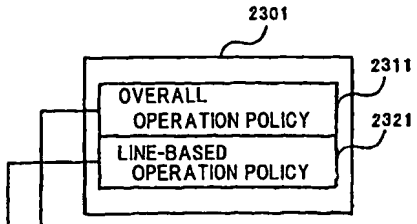

DOWNLOAD
COMMUNICATION RATE
PER UNIT HOUR
2600
ACTUAL
VALUE
TARGET MINIMUM VALUE
2610
30kbps
POINT A
POINT B

Fig. 28



2311

TARGET MINIMUM VALUE OF AVERAGE COMMUNICATION RATE	FROM POINT A TO POINT C	FROM POINT C TO POINT B
	800kbps	1000kbps
TARGET MAXIMUM VALUE OF COMMUNICATION FEE	¥1,000,000	

2321

COMMUNICATION IF TYPE	USAGE PRIORITY	AVERAGE DOWNLOAD RATE	AVERAGE UPLOAD RATE	BILLING SYSTEM	BILLING RATE	MAXIMUM NUMBER OF IF
PDO	4	10kbps	10kbps	TIME -DEPENDENT MEASURED-RATE	¥60/min	2
UMTS	2	220kbps	50kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.002/pkt	1
cdma2000 1×	3	60kbps	40kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.0015/pkt	2
1×EV-DO	1	700kbps	40kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.0015/pkt	2

Fig. 29

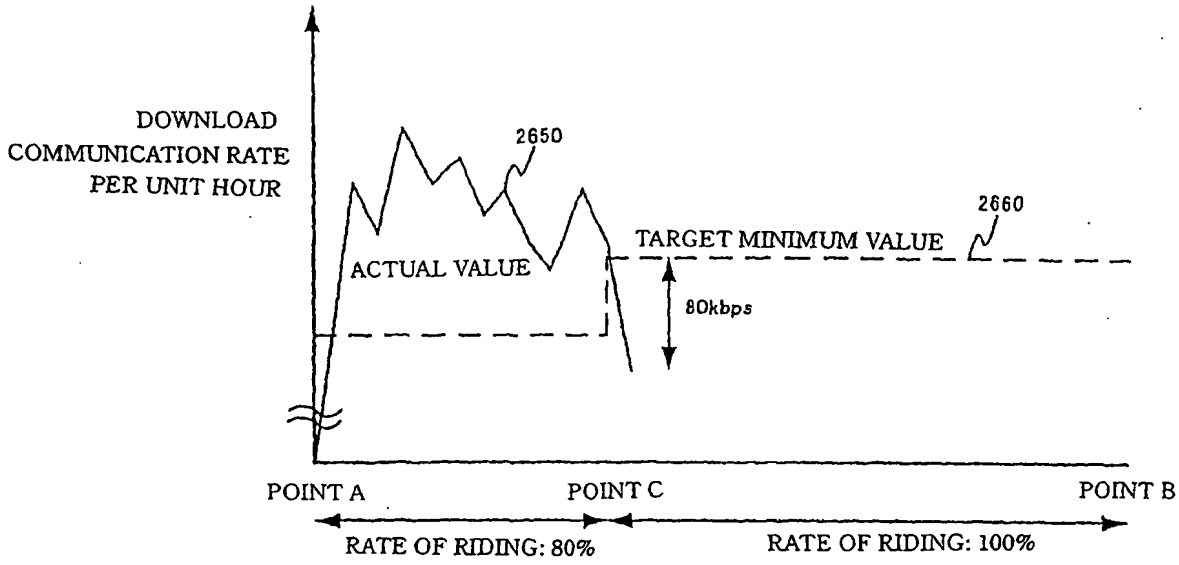

DOWNLOAD
COMMUNICATION RATE
PER UNIT HOUR
2650
2660
TARGET MINIMUM VALUE
ACTUAL VALUE
80kbps
POINT A
POINT C
POINT B
RATE OF RIDING: 80%
RATE OF RIDING: 100%

Fig. 30

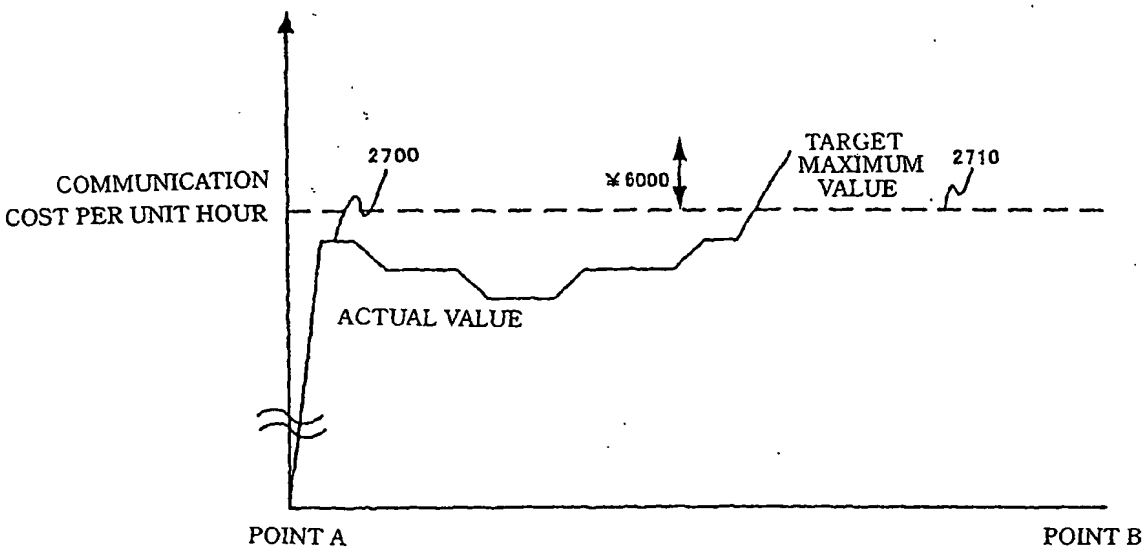

COMMUNICATION
COST PER UNIT HOUR
2700
¥6000
TARGET
MAXIMUM
VALUE
2710
ACTUAL VALUE
POINT A
POINT B

Fig. 31

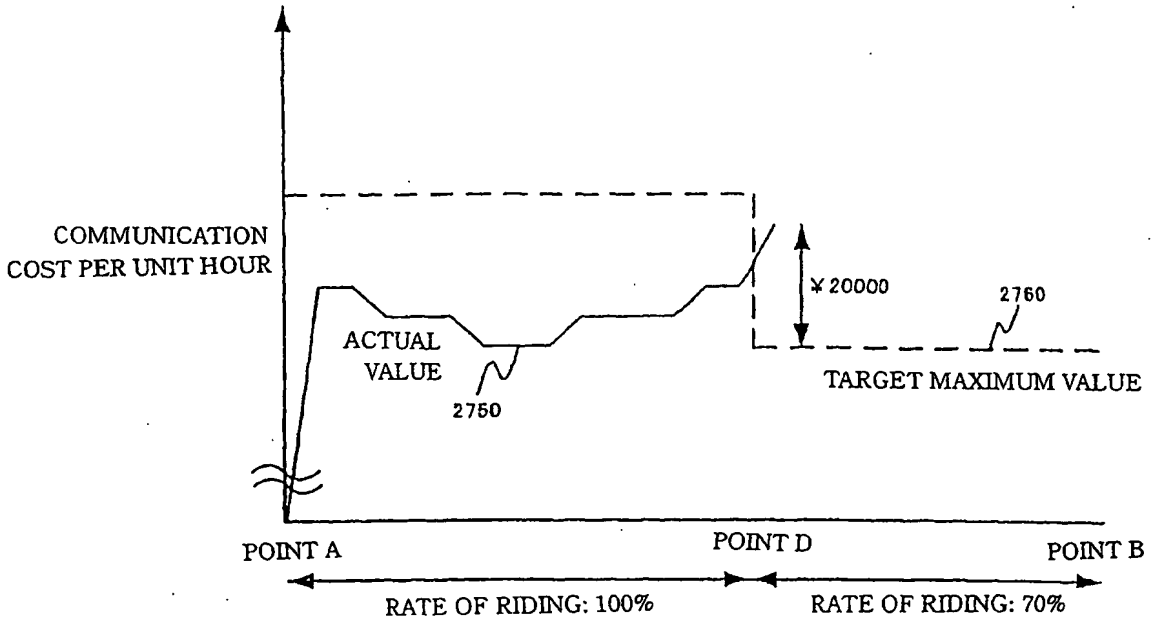
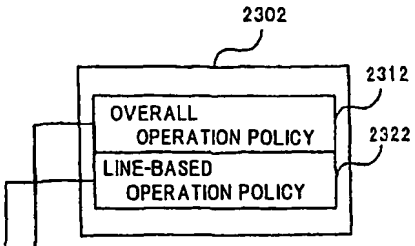

COMMUNICATION
COST PER UNIT HOUR
ACTUAL
VALUE
2750
¥20000
2760
TARGET MAXIMUM VALUE
POINT A
POINT D
POINT B
RATE OF RIDING: 100%
RATE OF RIDING: 70%

Fig. 32



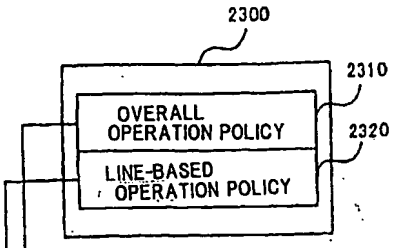
2312

TARGET MINIMUM VALUE OF AVERAGE COMMUNICATION RATE	FROM POINT A TO POINT D	FROM POINT D TO POINT B
	1000kbps	1000kbps
TARGET MAXIMUM VALUE OF COMMUNICATION FEE	¥700,000	¥300,000

2322

COMMUNICATION IF TYPE	USAGE PRIORITY	AVERAGE DOWNLOAD RATE	AVERAGE UPLOAD RATE	BILLING SYSTEM	BILLING RATE	MAXIMUM NUMBER OF IF
PDC	4	10kbps	10kbps	TIME -DEPENDENT MEASURED-RATE	¥60/min	2
UMTS	2	220kbps	50kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.002/pkt	1
cdma2000 1×	3	60kbps	40kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.0015/pkt	2
1×EV-DO	1	700kbps	40kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.0015/pkt	2

Fig. 33



2310

TARGET MINIMUM VALUE OF AVERAGE COMMUNICATION RATE	1000kbps
TARGET MAXIMUM VALUE OF AMOUNT OF INCREASE OF COMMUNICATION FEE PER UNIT HOUR	¥76000

2320

COMMUNICATION IF TYPE	USAGE PRIORITY	AVERAGE DOWNLOAD RATE	AVERAGE UPLOAD RATE	BILLING SYSTEM	BILLING RATE	MAXIMUM NUMBER OF IF
PDC	4	10kbps	10kbps	TIME -DEPENDENT MEASURED-RATE	¥60/min	2
UMTS	2	220kbps	50kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.002/pkt	1
cdma2000 1×	3	60kbps	40kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.0015/pkt	2
1×EV-DO	1	700kbps	40kbps	PACKET -DEPENDENT MEASURED-RATE	¥0.0015/pkt	2

Fig. 34

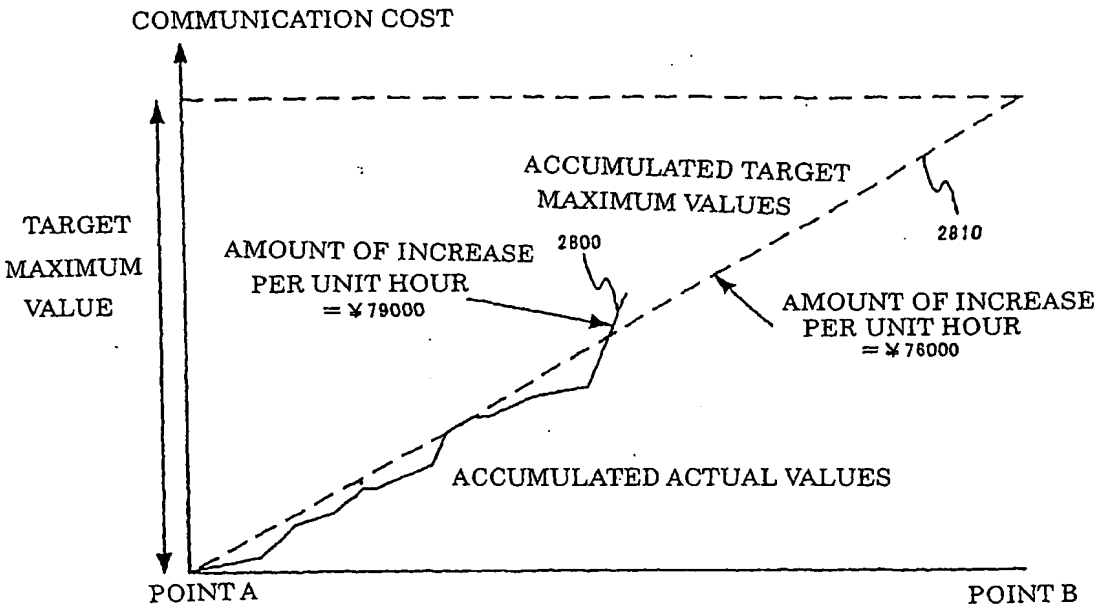
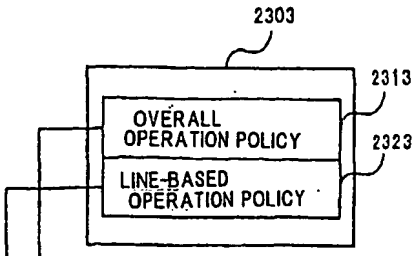

COMMUNICATION COST
TARGET MAXIMUM VALUE
ACCUMULATED TARGET MAXIMUM VALUES
2810
2800
AMOUNT OF INCREASE PER UNIT HOUR = ¥79000
AMOUNT OF INCREASE PER UNIT HOUR = ¥76000
ACCUMULATED ACTUAL VALUES
POINT A
POINT B

Fig. 35



2313

	POINT A TO POINT E	POINT E TO POINT B
TARGET MINIMUM VALUE OF AVERAGE COMMUNICATION RATE	1000kbps	1000kbps
TARGET MAXIMUM VALUE OF AMOUNT OF INCREASE OF COMMUNICATION FEE PER UNIT HOUR	¥120000	¥60000

2323

COMMUNICATION IF TYPE	USAGE PRIORITY	AVERAGE DOWNLOAD RATE	AVERAGE UPLOAD RATE	BILLING SYSTEM	BILLING RATE	MAXIMUM NUMBER OF IF
PDC	4	10kbps	10kbps	TIME-DEPENDENT MEASURED-RATE	¥60/min	2
UMTS	2	220kbps	50kbps	PACKET-DEPENDENT MEASURED-RATE	¥0.002/pkt	1
cdma2000 1×	3	60kbps	40kbps	PACKET-DEPENDENT MEASURED-RATE	¥0.0015/pkt	2
1×EV-DO	1	700kbps	40kbps	PACKET-DEPENDENT MEASURED-RATE	¥0.0015/pkt	2

Fig. 36

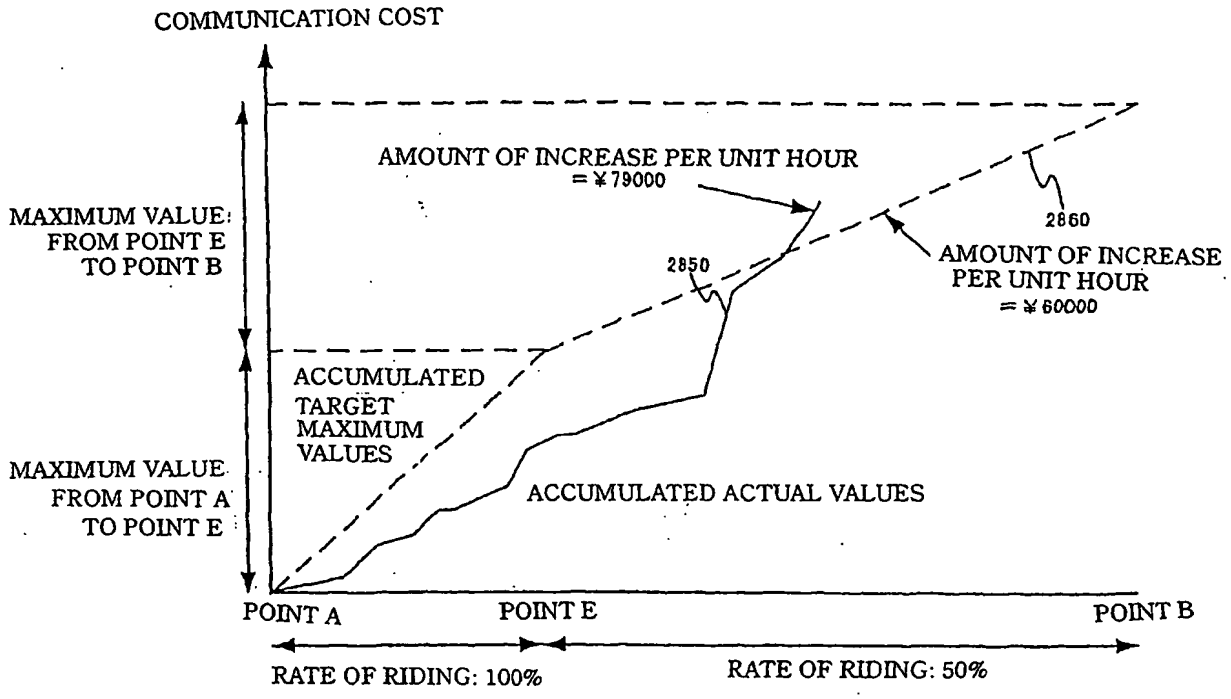

COMMUNICATION COST
AMOUNT OF INCREASE PER UNIT HOUR
= ¥79000
2860
AMOUNT OF INCREASE
PER UNIT HOUR
= ¥60000
2850
MAXIMUM VALUE
FROM POINT E
TO POINT B
ACCUMULATED
TARGET
MAXIMUM
VALUES
MAXIMUM VALUE
FROM POINT A
TO POINT E
ACCUMULATED ACTUAL VALUES
POINT A
POINT E
POINT B
RATE OF RIDING: 100%
RATE OF RIDING: 50%

Fig. 37

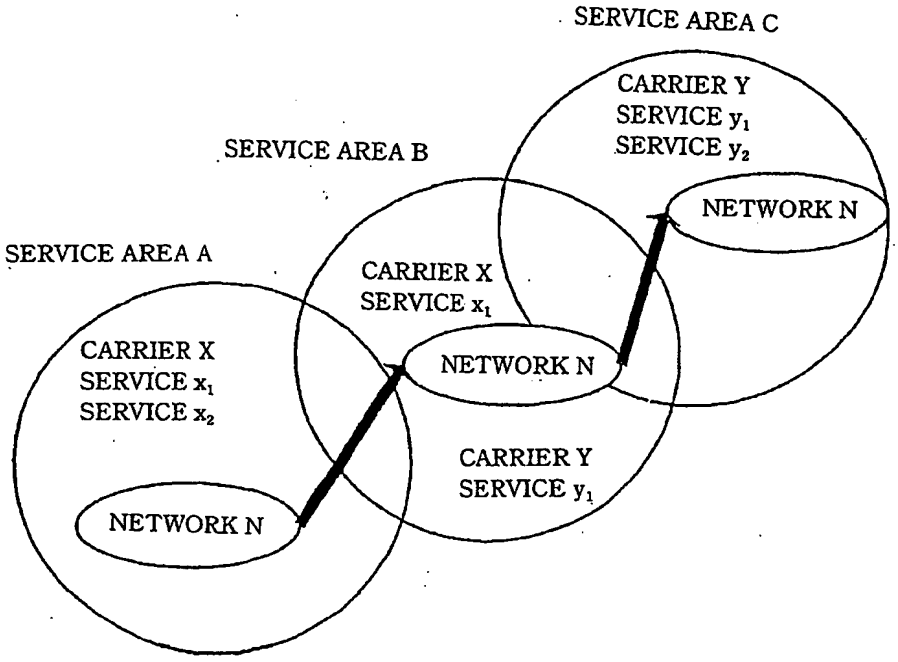

SERVICE AREA C
CARRIER Y
SERVICE y_1
SERVICE y_2
SERVICE AREA B
NETWORK N
SERVICE AREA A
CARRIER X
SERVICE x_1
CARRIER X
SERVICE x_1
SERVICE x_2
NETWORK N
CARRIER Y
SERVICE y_1
NETWORK N

Fig. 14

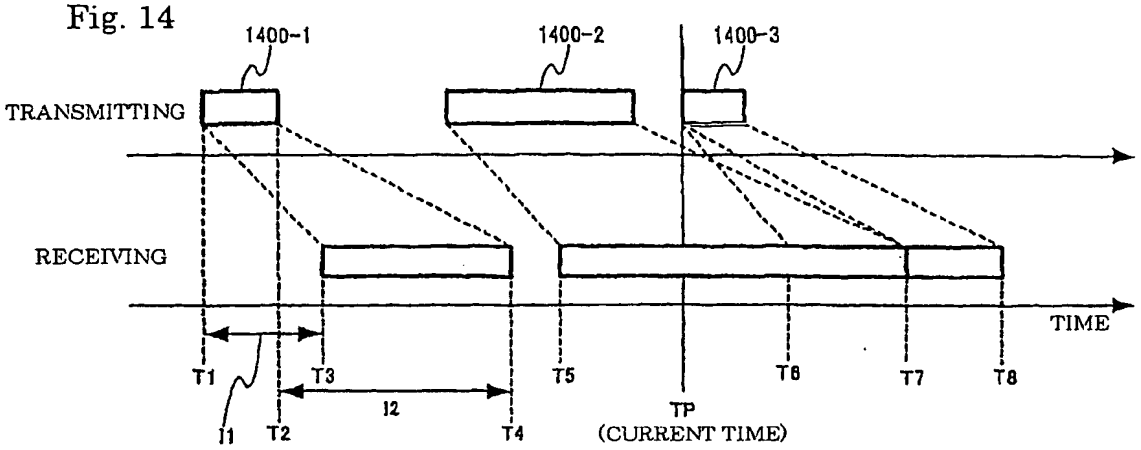

1400-1
1400-2
1400-3
TRANSMITTING
RECEIVING
TIME
T1
T2
T3
T4
T5
T6
T7
T8
I1
I2
TP
(CURRENT TIME)

FIG. 15

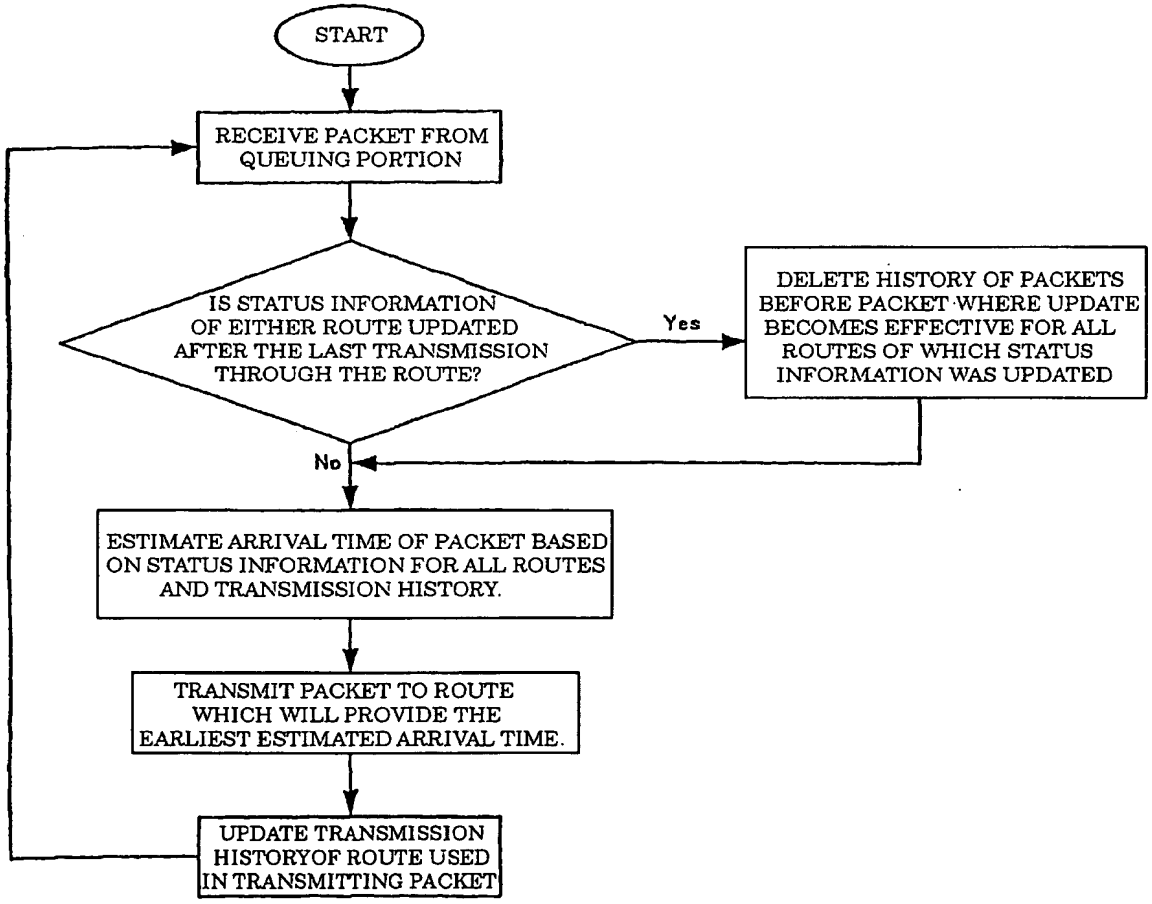

START
RECEIVE PACKET FROM QUEUING PORTION
IS STATUS INFORMATION OF EITHER ROUTE UPDATED AFTER THE LAST TRANSMISSION THROUGH THE ROUTE?
Yes
DELETE HISTORY OF PACKETS BEFORE PACKET WHERE UPDATE BECOMES EFFECTIVE FOR ALL ROUTES OF WHICH STATUS INFORMATION WAS UPDATED
No
ESTIMATE ARRIVAL TIME OF PACKET BASED ON STATUS INFORMATION FOR ALL ROUTES AND TRANSMISSION HISTORY.
TRANSMIT PACKET TO ROUTE WHICH WILL PROVIDE THE EARLIEST ESTIMATED ARRIVAL TIME.
UPDATE TRANSMISSION HISTORYOF ROUTE USED IN TRANSMITTING PACKET

Fig. 16

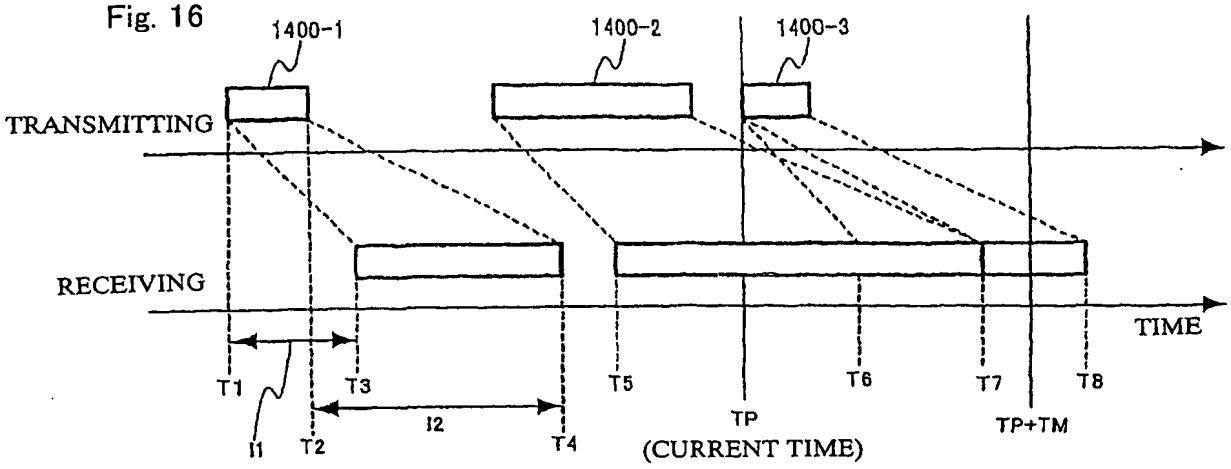

1400-1
1400-2
1400-3
TRANSMITTING
RECEIVING
TIME
T1
T2
T3
T4
T5
T6
T7
T8
TP
TP+TM
I1
I2
(CURRENT TIME)

FIG. 17

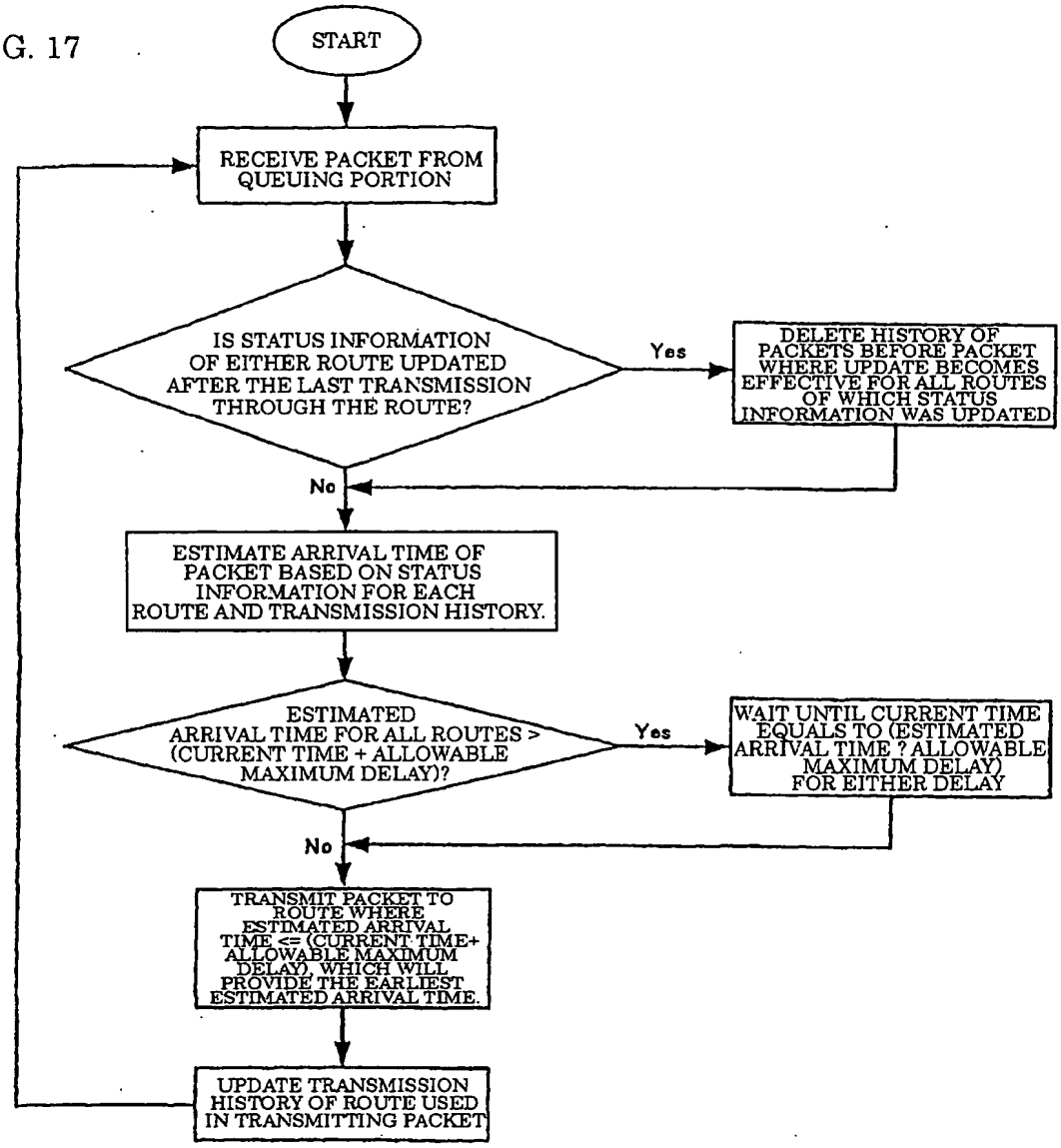

START
RECEIVE PACKET FROM QUEUING PORTION
IS STATUS INFORMATION OF EITHER ROUTE UPDATED AFTER THE LAST TRANSMISSION THROUGH THE ROUTE?
Yes
DELETE HISTORY OF PACKETS BEFORE PACKET WHERE UPDATE BECOMES EFFECTIVE FOR ALL ROUTES OF WHICH STATUS INFORMATION WAS UPDATED
No
ESTIMATE ARRIVAL TIME OF PACKET BASED ON STATUS INFORMATION FOR EACH ROUTE AND TRANSMISSION HISTORY.
ESTIMATED ARRIVAL TIME FOR ALL ROUTES > (CURRENT TIME + ALLOWABLE MAXIMUM DELAY)?
Yes
WAIT UNTIL CURRENT TIME EQUALS TO (ESTIMATED ARRIVAL TIME ? ALLOWABLE MAXIMUM DELAY) FOR EITHER DELAY
No
TRANSMIT PACKET TO ROUTE WHERE ESTIMATED ARRIVAL TIME <= (CURRENT TIME+ ALLOWABLE MAXIMUM DELAY), WHICH WILL PROVIDE THE EARLIEST ESTIMATED ARRIVAL TIME.
UPDATE TRANSMISSION HISTORY OF ROUTE USED IN TRANSMITTING PACKET

Fig. 18

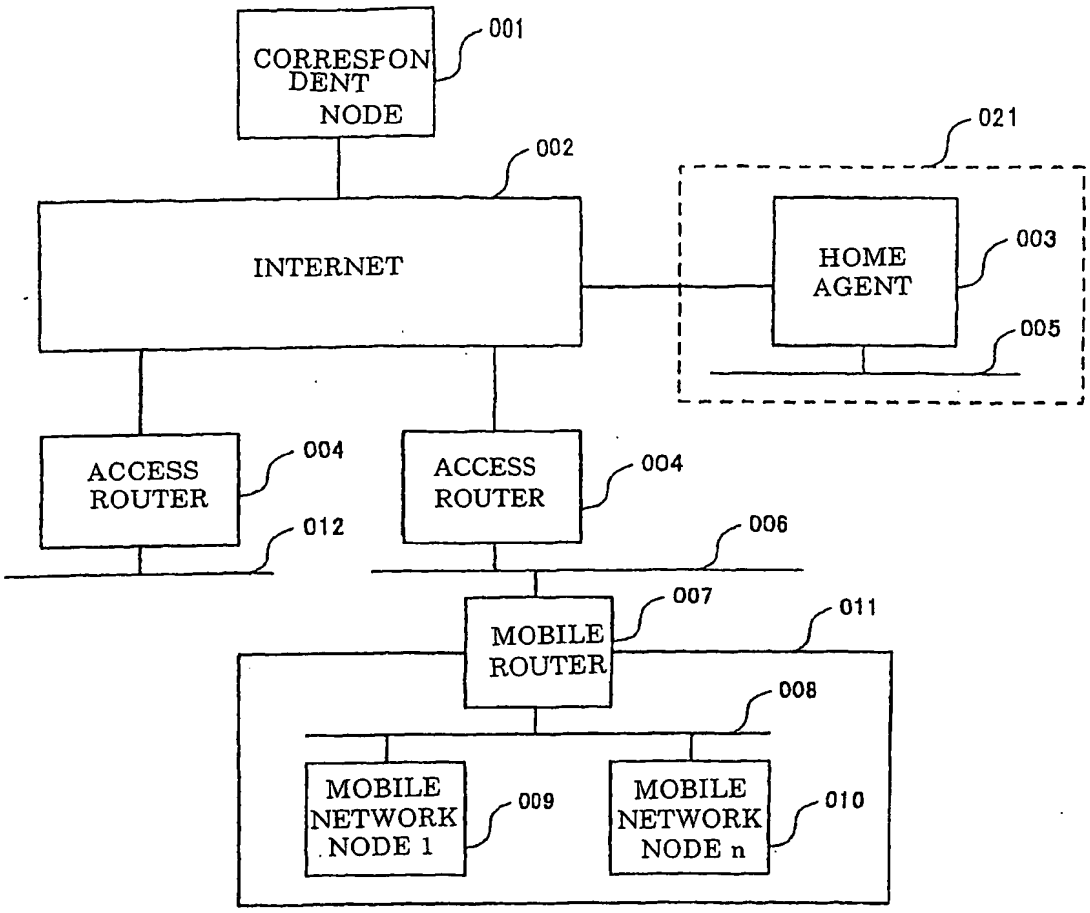

CORRESPON DENT NODE
001
021
002
INTERNET
HOME AGENT
003
005
ACCESS ROUTER
004
ACCESS ROUTER
004
012
006
MOBILE ROUTER
007
011
008
MOBILE NETWORK NODE 1
009
MOBILE NETWORK NODE n
010

Fig. 19

HOME ADDRESS	C/O ADDRESS	COMMUNICATION IF #	TYPE	BANDWIDTH	BILLING SYSTEM	STATUS
A.A.A..254/24	C.C.C.50	1	WIRELESS LAN	11Mbps	MEASURED-RATE	ALREADY REGISTERED
	B.B.B.200	2	IMT-2000	384kbps	MEASURED-RATE	ALREADY REGISTERED
	B.B.B.201	3	IMT-2000	384kbps	MEASURED-RATE	ALREADY REGISTERED
	B.B.B.202	4	IMT-2000	384kbps	MEASURED-RATE	ALREADY REGISTERED

10/526725

Fig. 20

HOME ADDRESS	C/O ADDRESS	COMMUNICATION IF #	TYPE	BANDWIDTH	BILLING SYSTEM	STATUS
A.A.A..254/24	C.C.C.50	1	WIRELESS LAN	11Mbps	FLAT-RATE	ALREADY REGISTERED
	B.B.B.200	2	IMT-2000	384kbps	MEASURED-RATE	ALREADY REGISTERED
	B.B.B.201	3	IMT-2000	384kbps	MEASURED-RATE	ALREADY REGISTERED
	B.B.B.202	4	IMT-2000	384kbps	MEASURED-RATE	ALREADY REGISTERED

10/526,729

Fig. 21

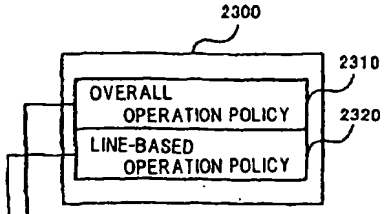
HOME ADDRESS	C/O ADDRESS	TYPE	BANDWIDTH	BILLING SYSTEM
A.A.A..254/24	C.C.C.50	WIRELESS LAN	11Mbps	MEASURED-RATE
	B.B.B.200	IMT-2000	384kbps	MEASURED-RATE
	B.B.B.201	IMT-2000	384kbps	MEASURED-RATE
	B.B.B.202	IMT-2000	384kbps	MEASURED-RATE

Fig. 22

HOME ADDRESS	C/O ADDRESS	TYPE	BANDWIDTH	BILLING SYSTEM
A.A.A..254/24	C.C.C.50	WIRELESS LAN	11Mbps	FLAT-RATE
	B.B.B.200	IMT-2000	384kbps	MEASURED-RATE
	B.B.B.201	IMT-2000	384kbps	MEASURED-RATE
	B.B.B.202	IMT-2000	384kbps	MEASURED-RATE

10/526725

Fig 23



2310

TARGET MINIMUM VALUE OF AVERAGE COMMUNICATION RATE	1000kbps
TARGET MAXIMUM VALUE OF COMMUNICATION FEE	¥1,000,000

2320

COMMUNICATION IF TYPE	USAGE PRIORITY	AVERAGE DOWNLOAD RATE	AVERAGE UPLOAD RATE	BILLING SYSTEM	BILLING RATE	MAXIMUM NUMBER OF IF
PDC	4	10kbps	10kbps	TIME-DEPENDENT MEASURED-RATE	¥60/min	2
UMTS	2	220kbps	50kbps	PACKET-DEPENDENT MEASURED-RATE	¥0.002/pkt	1
cdma2000 1×	3	60kbps	40kbps	PACKET-DEPENDENT MEASURED-RATE	¥0.0015/pkt	2
1×EV-DO	1	700kbps	40kbps	PACKET-DEPENDENT MEASURED-RATE	¥0.0015/pkt	2